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RADIUM MONITORING NETWORK

DATA RELEASE NUMBER 6

PUBLIC HEALTH SERVICE, DENVER, COLORADO

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DATA RELEASE NO. 6

U. S. Department of Health, Education, and Welfare
Public Health Service
Bureau of State Services
Division of Water Supply and Pollution Control
Region VIII
Denver, Colorado

Colorado River Basin Water Quality Control Project

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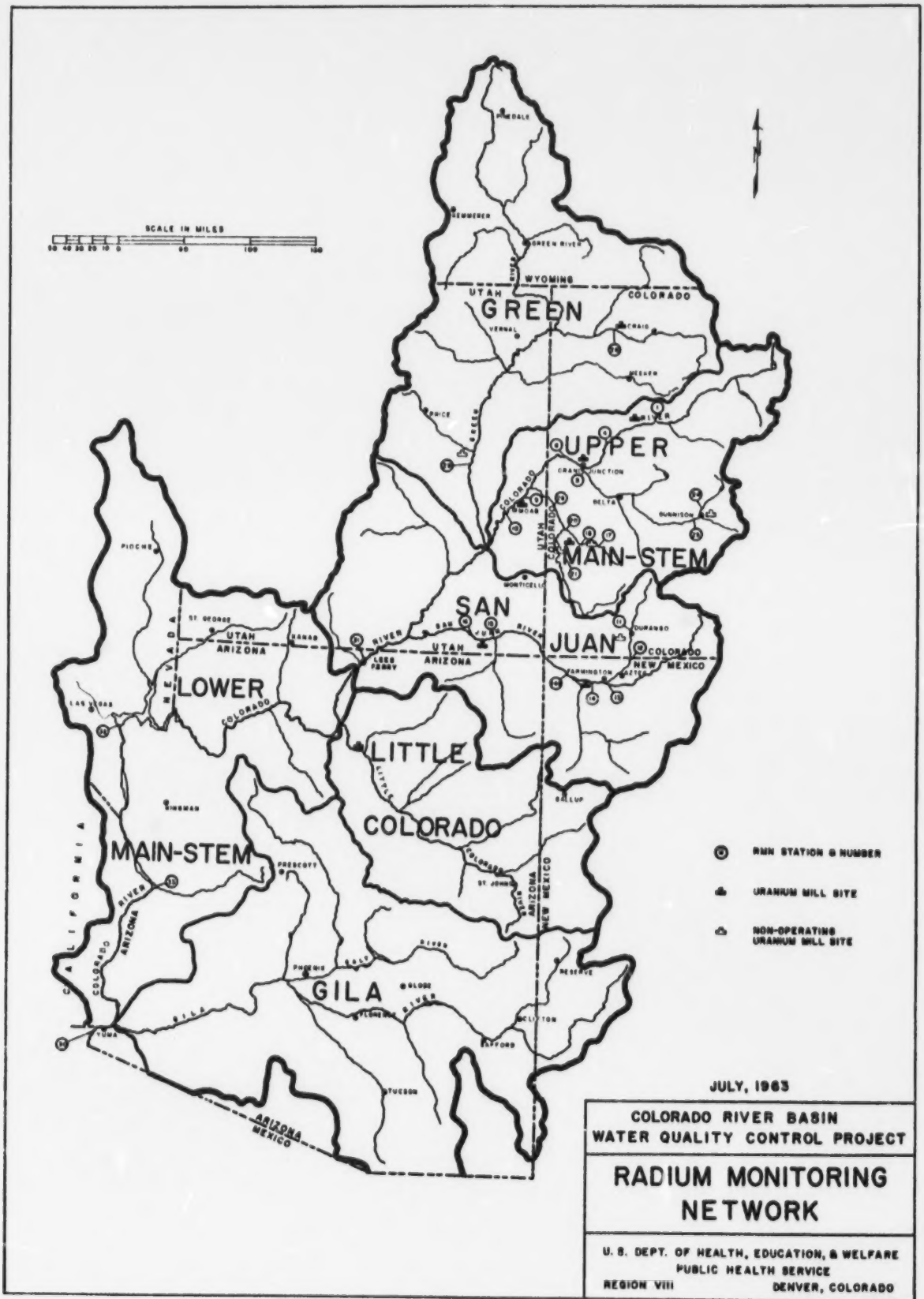

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FIGURE 1

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Report on Colorado River Basin Water Quality Control Project.

16. Abstracts
This sixth data release report contains available radium-226 and uranium results supplementing the data contained in the previous releases of October 1962, January 1963, July 1963, January 1964, and July 1964. The data indicate evidence of uranium mining and milling from analysis of composite water samples at stations of the Radium Monitoring Network established by the Colorado River Basin Water Quality Control Project. The network is a surveillance system consisting of continuous surface water sampling at 26 locations throughout the basin. It assays the radiological content of river water over the entire basin. Tabular data are presented.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

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River basins
*Radium
Drinking water
*Radiation hazards
Water supply
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*Water quality data
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Surface waters
Tables(Data)
*Uranium
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17c. COSATI Field/Group 13B

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COLORADO RIVER BASIN WATER QUALITY CONTROL PROJECT

RADIUM MONITORING NETWORK DATA RELEASE NO. 6

INTRODUCTION

This is the sixth release of data collected through the Radium Monitoring Network maintained by the Colorado River Basin Water Quality Control Project of the Division of Water Supply and Pollution Control, U. S. Public Health Service. The purpose of this release is to supplement data given in five previous releases dated October 1962, January 1963, July 1963, January 1964, and July 1964.

The Radium Monitoring Network is a surface water surveillance system consisting of twenty-five sampling stations located throughout the Colorado River Basin. The purpose of this network is to provide a continuous assay of the radioactivity content of river waters in the Basin resulting primarily from uranium milling industry waste discharges. The network was established after its need was recognized at a 1957 conference on uranium milling wastes attended by representatives of the States of Arizona, Colorado, New Mexico, and Utah, and the U. S. Public Health Service.

Depending on individual station parameters, Radium Monitoring Network (RMN) samples are collected as either daily or weekly grab samples, or by automatic samplers collecting 21 ml every hour. Radiochemical determinations are then conducted on the filtered water from weekly or monthly composites of the samples collected.

The Appendix contains the radium-226 and uranium data appended to that presented in the five previous data releases. Preliminary strontium-90, polonium-210, lead-210, and thorium results have been presented in previous releases. The Colorado River Basin Project Laboratory is currently obtaining additional data on these radioactivity parameters, and these results will be reported in an ensuing data release. These determinations have been added to the routine radium-226 and uranium determinations to provide a more comprehensive picture of radiological contaminants in Colorado River Basin waters.

DISCUSSION

Radium-226 concentration data from the six data releases gives comparisons shown below while individual station averages are given in Table I. Background stations are those upstream from uranium mining and milling operations or from natural contamination sources such as the radium bearing mineral springs near Glenwood Springs, Colorado.

Radium-226	Background Stations	Non-background Stations	All Stations
Average concentration (μμg/liter)	0.05	0.39	0.35
Range (μμg/liter)	0.00-0.19	0.01-7.2	0.00-7.2
Number of samples	134	1043	1177

No significant changes in monthly average concentrations were noted at any station during the reporting period, except at the station below Uravan, Colorado. A continuing general decrease in radium-226 concentrations in river water below the Uravan uranium mill was noted during this reporting period, in that monthly averages were only a little higher than at the station above Uravan. As can be seen in the data in the Appendix under RMN Station #20, the majority of the radium-226 results for this station were less than one μμg/liter. These data demonstrate the improvements made by the installation of uranium mill effluent seepage and evaporation ponds by the Uravan mill.

Only one isolated weekly sample produced a radium-226 concentration above the recommended drinking water yearly average limit of 3 μμg/liter (1). This value was 5.1 μμg/liter for the week of March 8, 1964 below Uravan. No station produced an average concentration over the reporting period above the suggested one μμg/liter desirable maximum for the Colorado River Basin surface waters (2).

Combined uranium concentration data from the six data releases provide the summary given below and individual station averages are listed in Table I. Uranium concentrations at all stations continue to range well below recommended limits (3).

Uranium	Background Stations	Non-background Stations	All Stations
Average concentration (μg/liter)	1.5	11	9.7
Range (μg/liter)	0.0-8.3	0.0-150	0.0-150
Number of samples	89	773	862

TABLE I

RADIUM-226 AND URANIUM IN SURFACE WATERS OF THE COLORADO RIVER BASIN

Station Number and Location	Radium-226 Avg.[a] µµg/l	Radium-226 Range µµg/l	Radium-226 No. of Analyses	Uranium Avg.[a] µg/l	Uranium Range µg/l	Uranium No. of Analyses
Animas River						
#11 above Durango, Colo.	0.05	0.03-0.11	32	1.2	0.1- 2.5	26
#12 Colorado-New Mexico State Line	0.31	0.09-1.5	82	4.1	0.4-18	40
Colorado River						
# 1 at Silt, Colorado	0.20	0.04-0.39	37	2.8	0.1- 4.4	23
# 4 at DeBeque, Colorado	0.19	0.05-0.44	38	3.4	0.4- 6.5	23
# 6 at Fruita, Colorado	0.19	0.09-0.26	32	9.1	3.2-14	23
# 9 above Moab, Utah	0.27	0.10-0.50	66	10	3.6-17	53
#10 below Moab, Utah	0.44	0.18-7.2	62	12	3.7-22	49
#31 at Page, Arizona	0.27	0.16-0.31	15	9.3	7.1-13	15
#32 Lake Mead	0.32	0.26-0.40	17	8.1	5.6-10	17
#33 Lake Havasu	0.35	0.06-0.39	19	8.2	5.9-11	19
#30 at Yuma, Arizona	0.17	0.06-0.32	27	8.2	5.9-11	22
Dolores River						
#21 at Bedrock, Colorado	0.49	0.03-1.4	35	13	0.9-35	22
#26 at Gateway, Colorado	1.2	0.04-3.2	74	11	0.1-51	51
Green River						
#28 below Maybell, Colo.	0.09	0.03-0.15	26	2.6	0.6- 8.0	22
#29 below Green River, Utah	0.09	0.05-0.15	24	5.2	1.6- 7.6	21
Gunnison River						
#24 above Gunnison, Colo.	0.05	0.01-0.08	32	1.1	0.0- 2.6	22
#25 below Gunnison, Colo.	0.04	0.01-0.09	35	2.0	0.6- 3.6	22
# 5 at Grand Junction, Colo.	0.10	0.01-0.30	32	10	0.7-17	23
San Juan River						
#13 above Farmington, N.M.	0.07	0.03-0.16	20	2.8	0.0- 8.3	19
#14 below Farmington, N.M.	0.10	0.04-0.21	23	3.8	0.9- 9.0	22
#14S below Shiprock, N.M.	0.11	0.04-0.26	68	15	2.1-93	65
#15 above Mexican Hat, Utah	0.13	0.06-0.26	36	7.3	2.6-13	23
#16 below Mexican Hat, Utah	0.15	0.03-0.84	87	8.2	0.8-17	69
San Miguel River						
#17 above Naturita, Colo.	0.04	0.00-0.19	50	1.2	0.0- 3.9	22
#18 above Uravan, Colo.	0.24	0.05-1.24	84	7.0	0.9-63	53
#20 below Uravan, Colo.	1.1	0.06-5.6	124	27	0.0-150	96

a/ Average concentration obtained from all data presented in this and previous data releases.

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1. Drinking Water Standards, U. S. Public Health Service, 1962 Edition, U. S. Government Printing Office, Washington, D. C.

2. Transcript, Third Session Conference on Pollution of the Interstate Waters of the Colorado River and Its Tributaries, May 1962, Department of Health, Education and Welfare, Region VIII, Denver, Colorado.

3. International Committee on Radiological Protection: Report of Committee II on Permissible Dose for Internal Radiation, 1959, Pergammon Press, Inc., New York, New York.

APPENDIX

RMN Station 1: Colorado River at Silt, Colorado
Started: November 25, 1961
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
February 29-March 28	0.35	3.2
March 28-May 2	0.18	3.5
May 2-May 30	0.11	1.5
May 30-June 27	0.08	1.2
June 27-August 1	0.15	2.7
August 1-August 29	0.19	2.2

RMN Station 4: Colorado River above DeBeque, Colorado
Started: November 12, 1961
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
February 29-March 28	0.30	4.4
March 28-May 2	0.24	2.9
May 2-May 30	0.15	1.8
May 30-June 27	0.08	1.3
June 27-August 1	0.14	2.9
August 1-August 29	0.15	3.2

RMN Station 5: Gunnison River above Grand Junction, Colorado
Started: April 16, 1962
Type: Three grab samples per week

Date 1964	Radium-226 μμg/liter	Uranium μg/liter
March 2-March 27	0.08	12
March 30-May 1	0.10	4.4
May 4-May 29	0.09	3.5
June 1-June 26	0.30	4.0
June 29-July 31	0.16	8.9
August 3-August 28	0.15	10

RMN Station 6: Colorado River near Fruita, Colorado
Started: April 16, 1962
Type: Three grab samples per week

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 27	0.20	7.6
March 30-May 1	0.10	10
May 4-May 29	0.20	5.7
June 1-June 26	0.16	3.2
June 29-July 31	0.18	8.9
August 3-August 28	0.15	8.8

RMN Station 9: Colorado River above Moab, Utah
Started: December 11, 1961
Type: Three grab samples per week

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 27	0.24	13
March 30-May 1	0.31	9.7
May 4-May 29	0.25	5.6
June 1-June 26	0.19	3.6
June 29-July 31	0.24	7.8
August 3-August 28	0.28	12

RMN Station 10: Colorado River below Moab, Utah
Started: December 11, 1961
Type: Three grab samples per week

Date 1964	Radium-226 μμg/liter	Uranium μg/liter
March 2-March 27	0.29	13
March 30-May 1	0.29	9.7
May 4-May 29	0.23	5.6
June 1-June 26	0.23	3.7
June 29-July 31	0.28	8.5
August 3-August 28	0.28	8.6

RMN Station 11: Animas River at Durango, Colorado
Started: July 17, 1961
Type: Three grab samples per week

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 9-March 13	0.03	0.1
March 16-March 27	0.05	0.7
March 30-May 1	0.05	0.9
May 4-May 29	0.04	0.6
June 13-June 26	0.05	0.7
June 28-July 30	0.04	0.7
August 3-August 28	0.08	0.9

RMN Station 12: Animas River at Colorado-New Mexico State Line
Started: January 19, 1961
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
May 5-May 30	0.14	1.3
June 2-June 27	0.19	0.7
July 2-July 30	0.14	1.4

RMN Station 13: San Juan River above Farmington, New Mexico
Started: July 9, 1962
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 23	0.03	1.2
March 30-April 27	0.08	2.2

Station discontinued

RMN Station 14: San Juan River at Fruitland, New Mexico
Started: August 1, 1962
Type: One grab sample per week

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 23	0.05	2.0
March 30-April 27	0.09	2.4
May 3-May 26	0.09	2.1
June 2-June 23	0.10	0.9
June 30-July 28	0.06	1.6

RMN Station 14S: San Juan River below Shiprock, New Mexico
Started: August 7, 1962
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 6	0.06	2.9
March 9-March 11	0.04	2.9
March 16-March 18	0.05	2.7
March 23-March 27	0.06	2.2
April 1-	0.11	1.8
April 8-	--	---
April 15	0.11	40
April 22	0.11	36
April 29	0.26	93
May 11	0.13	67
May 14	0.10	16
May 20	0.11	3.8
May 27	0.08	2.1
June 3	0.13	8.8
June 10	0.11	13
June 18	0.11	2.3
June 24	0.11	3.5
July 8	0.11	8.4
July 15	0.06	5.6
July 22	0.10	6.8
July 29	0.08	5.0
August 6	0.06	5.5
August 12	0.10	3.0
August 19	0.08	5.5
August 26	0.10	7.6

RMN Station 15: San Juan River above Mexican Hat, Utah
Started: December 11, 1961
Type: Six daily grab samples per week

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 28	0.09	5.9
March 30-May 2	0.09	7.9
May 4-May 30	0.13	5.9
June 1-June 27	0.11	2.6
June 29-August 1	0.11	3.0
August 3-August 29	0.13	5.8

RMN Station 16: San Juan River below Mexican Hat, Utah
Started: December 11, 1961
Type: Six daily grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 7	0.06	9.4
March 9-March 14	0.05	8.7
March 16-March 21	0.05	8.7
March 23-March 28	0.08	8.4
March 30-April 3	0.05	8.1
April 6-April 11	0.09	9.6
April 13-April 18	0.09	8.2
April 20-April 25	0.11	8.1
April 27-May 2	0.09	8.5
May 4-May 9	0.05	11
May 9-May 18	---	--
May 18-May 23	0.15	8.2
May 25-May 30	0.09	7.6
June 1-June 6	0.10	4.5
June 8-June 13	0.09	3.2
June 15-June 20	0.08	2.0
June 22-June 27	0.08	3.9
June 29-July 4	0.11	3.0
July 6-July 11	0.18	3.6
July 13-July 18	0.10	2.9
July 20-July 25	0.09	3.2
July 27-August 1	0.08	3.7
August 3-August 8	0.08	4.9
August 10- August 15	0.09	6.0
August 17-August 22	0.11	6.2
August 24-August 29	0.18	6.2

RMN Station 17: San Miguel River above Naturita, Colorado
Started: October 28, 1961
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
February 29-March 29	0.04	0.1
March 29-May 3	0.19	3.2
May 3-May 30	0.10	0.9
May 30-June 28	0.10	0.0
June 28-August 1	0.01	1.0

RMN Station 18: San Miguel River above Uravan, Colorado
Started: October 27, 1961
Type: Automatic Pump-Timer

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
February 29-March 29	0.11	2.5
March 29-May 3	0.19	3.2
May 3-May 30	0.20	1.8
May 30-June 28	0.18	0.9
June 28-August 1	0.15	3.7
August 1-August 29	0.08	1.2

RMN Station 20: San Miguel River below Uravan, Colorado
Started: October 9, 1961
Type: Automatic Pump-Timer

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
February 29-March 8	1.78	27
March 8-March 14	5.16	54
March 14-March 22	1.40	58
March 22-March 29	1.56	58
March 29-April 5	0.65	110
April 5-April 12	1.91	84
April 12-April 19	0.25	5.9
April 19-April 26	0.36	5.3
April 26-May 3	0.35	4.1
May 3-May 10	0.21	3.7
May 10-May 17	0.40	2.9
May 17-May 24	0.06	0.3
May 24-May 31	0.20	2.1
May 31-June 6	0.24	5.2
June 6-June 13	0.35	4.6
June 13-June 21	0.31	5.5
June 21-June 28	0.24	4.5
June 28-July 5	0.40	10
July 5-July 12	0.33	12
July 12-July 19	0.34	14
July 19-July 27	0.55	16
July 26-August 1	1.08	44

RMN Station 21: Dolores River at Bedrock, Colorado
Started: October 30, 1961
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.53	17
March 30-May 1	0.27	6.8
May 4-May 29	0.19	2.6
June 1-June 26	0.20	2.0
June 29-July 31	0.59	11

RMN Station 24: Gunnison River above Gunnison, Colorado
Started: December 11, 1961
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.05	0.7
March 30-May 1	0.01	1.5
May 4-May 29	0.03	1.5
June 1-June 26	0.05	0.6
June 29-July 31	0.08	1.0

RMN Station 25: Gunnison River below confluence of Tomichi Creek, Gunnison, Colorado
Started: December 5, 1961
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.03	1.8
March 30-May 1	0.08	2.9
May 4-May 29	0.03	2.2
June 1-June 26	0.06	1.0
June 29-July 31	0.06	1.9

RMN Station 26: Dolores River at Gateway, Colorado
Started: December 26, 1961
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 28	1.65	51
March 30-May 1	0.81	34
May 4-May 28	0.48	6.8
June 1-June 26	0.51	4.0
June 29-August 1	0.95	13

RMN Station 28: Yampa River below Maybell, Colorado
Started: July 2, 1962
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.10	0.9
March 30-May 1	0.09	7.9
May 4-May 29	0.06	1.8
June 1-June 26	0.05	0.6
June 29-July 31	0.06	1.7

RMN Station 29: Green River below Green River City, Utah
Started: July 16, 1962
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.09	3.9
March 30-May 1	0.09	6.3
May 4-May 29	0.09	3.6

RMN Station 30: Colorado River at U. S.-Mexican Border
Started: June 19, 1961
Type: Five grab samples per week

Date	Radium-226 μμg/liter	Uranium μg/liter
1964		
March 2-March 27	0.24	9.0
March 30-May 1	0.19	8.2
May 4-May 29	0.11	7.9
June 1-June 25	0.16	7.5
June 29-July 31	0.25	8.8

RMN Station 31: Colorado River at Page, Arizona
Started: May 1, 1963
Type: 300 cc. composite per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 30	0.31	7.5
April 1-April 30	0.29	11
May 4-May 25	0.30	9.1
June 1-June 29	0.26	9.2
July 6-July 26	0.30	11

RMN Station 32: Colorado River at (Lake Mead) Boulder City, Nevada
Started: March 11, 1963
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.34	9.0
March 30-April 29	0.31	9.6
May 4-May 29	0.31	7.9
June 1-June 26	0.26	6.9
June 29-July 31	0.28	8.9

RMN Station 33: Colorado River at Metropolitan Water District Intake, Lake Havasu, California-Arizona
Started: January 7, 1963
Type: Three grab samples per week

Date	Radium-226 µµg/liter	Uranium µg/liter
1964		
March 2-March 27	0.35	7.9
March 29-May 2	0.36	8.1
May 5-May 29	0.33	8.8
May 31-June 25	0.29	7.2
June 28-July 31	0.39	7.9